RAILROAD GAZETTE

SATURDAY, JANUARY 31, 1874.

[Entered according to Act of Congress, in the year 1874, by the RAILROAD GAZETTE, in the office of the Librarian of Congress, at Washington.]

CATECHISM OF THE LOCOMOTIVE.

PART IV.

THE SLIDE VALVE.

QUESTION 40. *What are the essential conditions which a slide-valve must fulfill in governing the admission and exhaust of steam to and from the cylinder of an ordinary engine?*

Answer. 1. It must admit steam to one end only of the cylinders at one time. 2. It must allow the steam to escape from one end at least as soon as it is admitted to the other end; and 3, it must cover the steam-ports so as not to permit the steam to escape from the steam-chest into the exhaust-port.

QUESTION 41. *What was the first form of slide-valve used?*

Answer. That represented in fig. 10. The smallest movement of this valve either way opens one of the steam-ports for the admission of steam and puts the other in communication with the exhaust-port. By cutting a piece of ordinary writing paper to the form of the section of the valve, and moving it on the line *f f*, the action of the valve will be clearly shown.

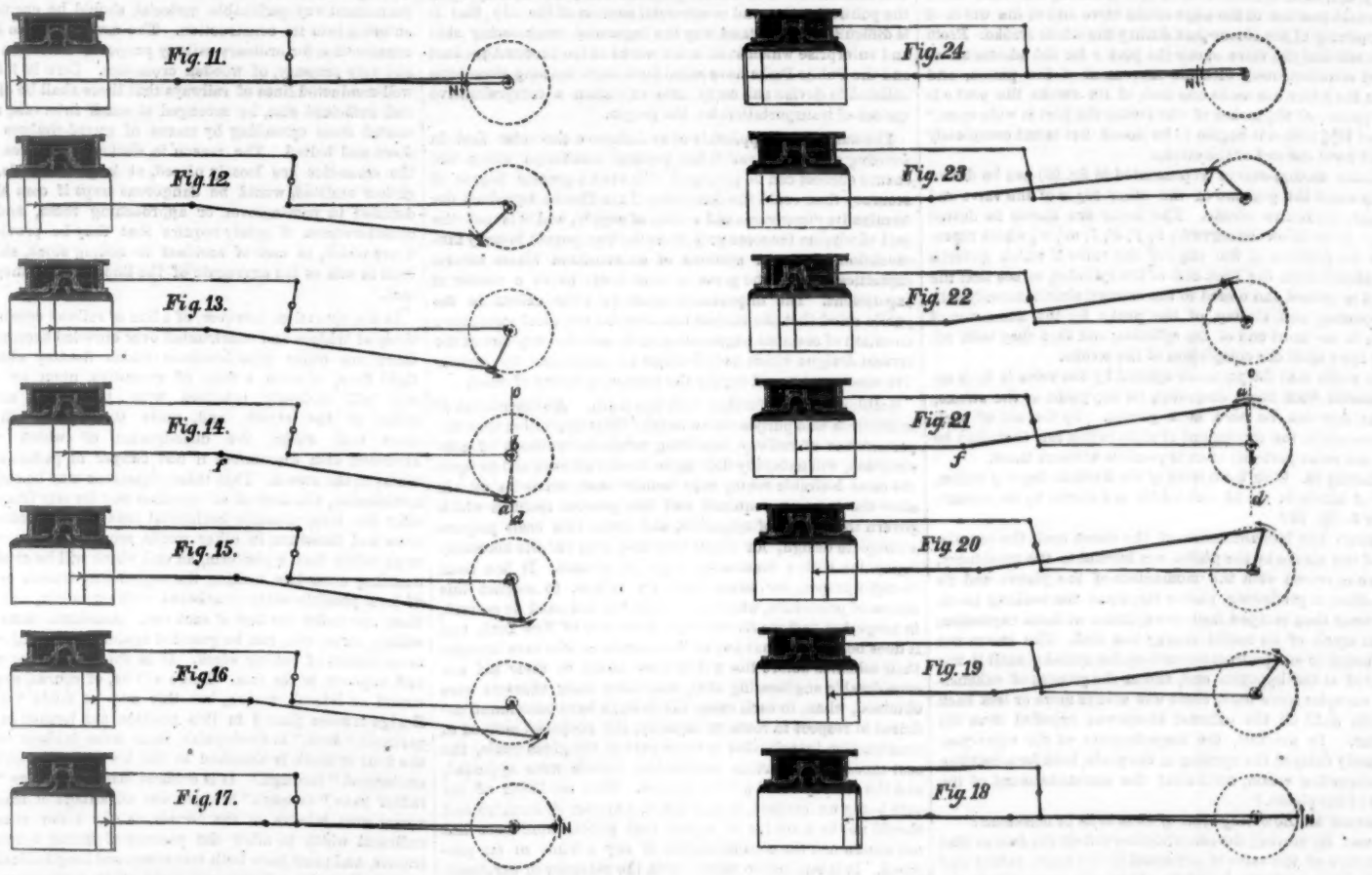
QUESTION 42. *How was the admission and escape of the steam effected by this valve?*

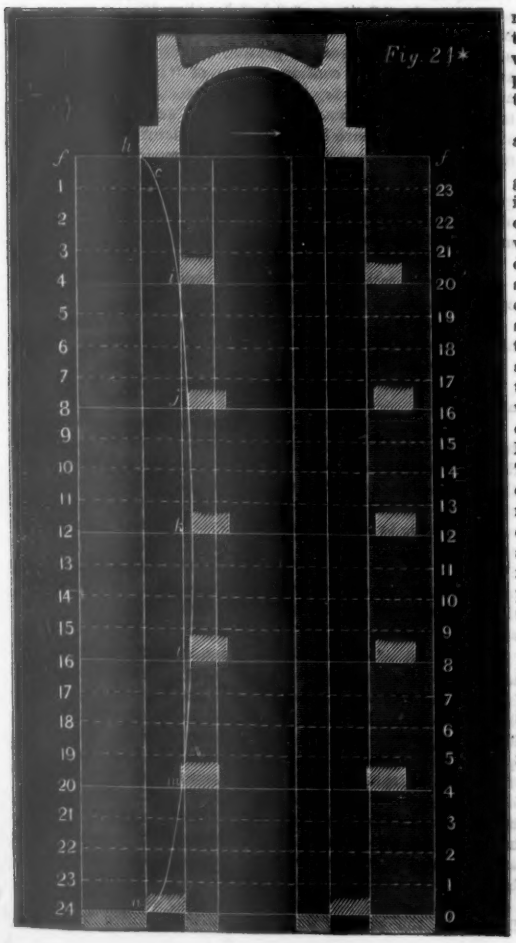
Answer. In order to explain this clearly, a series of diagrams will be necessary. Before referring to them, however, it should be explained first that the motion of an eccentric is exactly the same as that of a small crank. It is in fact a crank with a crank-pin whose diameter is very much enlarged. In the diagrams, figs. 11 to 25, the eccentrics will therefore be represented as small cranks, and most of the other parts by their centre-lines and points only, so as to make the diagrams as simple as possible. The dimensions selected for these illustrations are for the cylinder 16 in. diameter and 24 in. stroke and a connecting-rod 7 ft. long. The steam-ports are 1¼ in., the exhaust-port 2¼ in., and the metal or bars between them, which are called *bridges*, are 1⅛ in. wide. The eccentric produces a lateral movement of 3 in., which is called its *throw*. In fig. 11 the piston is at the beginning of the backward stroke. The valve is then in the centre of the valve-face, and the eccentric is consequently at half-throw. The slightest movement of the crank in the direction of the dark N will move the eccentric enough to open the front steam-port to the steam and the back one to the exhaust. In fig. 12 the piston is represented as having moved 4 in. of its stroke; the valve has then partly opened the front steam-port, and the other one is open to the exhaust. In fig. 13 the piston has made 8 in. of its stroke, and the ports are now wide open, the front one to the steam and the back one to the exhaust. In fig. 14 the piston has moved 12 in., or is at half-stroke, and the valve has then moved as far as it will in that direction. In fig. 15 the piston has moved 16 in. and the valve has begun to return. In fig. 16 the piston has moved 20 in. and the valve has nearly closed the front port to the steam and the other to the exhaust. In fig. 17 the forward stroke is completed, and both ports are closed by the valve. Figs. 18, 19, 20, 21, 22, and 23, represent the piston and the valve on the return stroke in the positions corresponding with those described for the backward stroke.

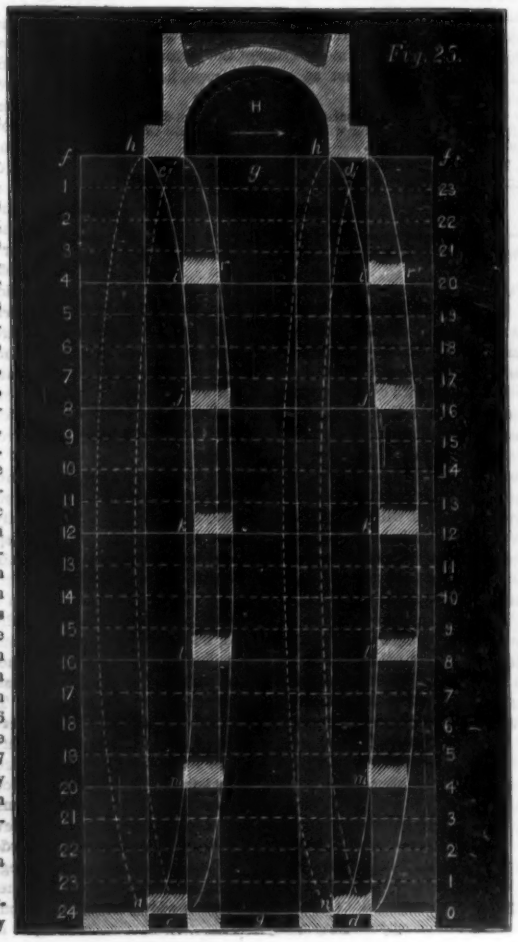
QUESTION 43. *Is there any other method by which the motion of a valve can be represented by a drawing?*

Answer. Yes: by what are called *motion-curves*. It is, however, difficult to explain these clearly, and as they are purely imaginary, it is difficult to understand their nature and purpose. Close attention will therefore be required to the following description:

We will suppose, in the first place, that the line *f, f*, fig. 24, represents the valve-face, *c* and *d* the steam and *g* the exhaust-port, drawn to a larger scale than in the preceding figures. We will now draw the valve *H* in the position represented in fig. 11, where the piston is at the beginning of the stroke. In order to show the valve in the position represented in fig. 12, where the piston has moved 4 in. of the stroke, we will draw a line 4, 20, four inches below and parallel to *f, f*, and extend the lines, representing the edges of the ports *c*, *d* and *g*, downward. On the horizontal line 4, 20 we will now draw the edges *i*, *r*, *i'*, *r'*, of the valve in the same position in relation to the port *c* that it has in fig. 12. We will then draw another horizontal line, 8, 16, eight inches below *f, f*, and parallel to it, and in this represent the valve in the position shown in fig. 13. In the same way we will draw lines 12, 16, 20 and 24 in. below







f, *f*, and draw the valve on each one respectively in the positions shown in figs. 14, 15, 16 and 17. The distance between the lower line 0, 24, and *f*, *f*, will then represent the stroke of the piston, or 24 in. If now we begin from the edge *a* of the valve on the line *f*, *f*, and draw a curve *h*, *i*, *j*, *k*, *l*, *m*, *n*, through the same edge of the valve, represented in each of the parallel lines below, the curve will indicate the position of the valve in relation to the steam-port *c* at each point of the stroke. To illustrate this, suppose we draw lines 1, 23, 2 22, and 3, 21 one inch apart and parallel to *f*, *f*, and between it and 4, 20. They will then represent the position of the piston after it has moved 1, 2 and 3 in. from the beginning of the stroke, and where they intersect the curved line will be the position of the edge of the valve when the piston has moved 1, 2 and 3 in. of the stroke. The curved line will in fact represent the position of the valve at any point of the stroke between these lines. Other horizontal lines, 5, 19, 6, 18, can be drawn to represent every inch of the rest of the stroke. The curve line *h*, *i*, *j*, *k*, *l*, *m n*, or *motion curve* as it is called, will then show the exact position of the edge of the valve and of the width of the opening of the steam-port during the whole stroke. From it we see that the valve opens the port *c* for the admission of steam simultaneously with the movement of the piston, and when the latter has made one inch of its stroke the port *c* is half open. At 4⅛ inches of the stroke the port is wide open,* and at 19⅛ inches it begins to be closed, but is not completely closed until the end of the stroke.

Similar motion-curves (represented in fig. 25) can be drawn to represent the position of the other edges of the valve and also for the return stroke. The latter are shown in dotted lines. If we follow the curve *h'*, *i'*, *j'*, *k'*, *l'*, *m'*, *n'*, which represents the position of the edge of the valve *h'* which governs the exhaust from the back end of the cylinder, we see that the port *d* is opened and closed to the exhaust simultaneously with the opening and closing of the port *c* for the admission of steam to the front end of the cylinder, and that they both remain open until the completion of the stroke.

The width that the ports are opened by the valve is thus ascertainable from these diagrams, for any point of the stroke, and in fact can be seen at a glance. By the aid of such motive-curves, the movement of slide valves can therefore be analyzed more perfectly than is possible without them.

QUESTION 44. *What were some of the disadvantages of valves, like that shown in fig.* 10, *and which are shown by the motion-curves in fig.* 25?

Answer. The free admission of the steam until the completion of the stroke by the piston was hurtful to the machinery, as it co-operated with the momentum of the piston and its connection in producing undue strains in the working parts. The steam then escaped from the cylinder without expansion, so that much of its useful energy was lost. The steam was not allowed to escape from one end of the cylinder until it was admitted at the opposite end, and as the process of exhausting it occupies some time, there was always more or less back pressure until all the exhaust steam was expelled from the cylinder. In practice, the imperfections of the valve-gear frequently delayed the opening of the ports, both for admitting and exhausting steam, until after the commencement of the stroke of the piston.†

QUESTION 45. *How may some of these evils be overcome?*

Answer. By moving the eccentric forward on the axle so that the motion of the valve is advanced to the same extent and the admission and exhaust of the steam will occur a little before the completion of the stroke of the piston. In this way the steam is admitted into the cylinder so as to act as a cushion to receive the momentum of the piston, and some time is given to the exhaust steam to escape, before the return stroke.

* By placing a paper section of the valve in the diagram in each position named, the reader will probably understand the movement of the valve more clearly.

†D. K. Clark's "Railway Machinery."

Contributions.

Requisites of a New York City Passenger Railroad.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The city of New York derives her prosperity from and boasts in the supremacy of commerce, assured by natural advantages unequaled by those of any great city in the world. Her great length, small breadth and extensive water front indicate that with an adequate system of docks and warehouses, merchandise transportation would be resolved into lines of travel across, rather than in direction of, the island, and thus become, as the result of short carriage and little likelihood of obstruction, a matter of comparatively small expense. The peculiar conformation of the city further suggests that a *few* lines of transit will suffice for the conveyance of persons between their business and their homes, and that as travel must occur in given directions without possibility of divergence and be considerable in proportions, this conveyance can be effected for a small rate of fare.

The observer looks in vain, however, for evidence that these natural advantages have been utilized, and is forced to conclude that what greatness the city possesses has been achieved in face of the most untoward circumstances. The improvement of the water front is of the most temporary and insufficient character; and the arrangement of warehouses being such as to render available in but a limited degree the movement of merchandise by water, and the longitudinal streets being few in number, in large part badly paved and obstructed with lines of railway, this carriage is effected upon the surface with great loss of time and expense. The matter of passenger transit is in even more deplorable condition, the most primitive methods of transportation, long since demonstrated to have outlived their usefulness, continuing down to the present day the sole resources of the people—a crowning shame to their lack of energy and ingenuity.

It is gratifying to know that a system of dock construction is in progress which promises, in consummation, to utilize in the highest degree the facilities which Nature has afforded for the successful conduct of commerce, and if there is any regret which may be expressed in connection with this work, it is that a method of construction had not been adopted admitting of more immediate results than can be hoped for with the massive system of masonry which it is purposed to employ. The problem remaining unsolved seems, however, to involve the comfortable and rapid transit of persons rather than the carriage of merchandise. Continued failure to supply an adequate means of city transit has fostered the growth of a dangerous tenement system, breeding paupers and criminals to prey upon the public purse and safety, has denuded the city of the middle classes, always an invaluable balance wheel to political action, and in their exile given opportunity for corruption and inefficiency in the public departments, has checked the increase of population and been a source of injury to trade and commerce. The transit question bears so directly upon the political action and commercial success of the city that it is difficult to understand why the ingenuity, engineering skill and enterprise which such noble works as the Croton Aqueduct and the Public Parks have called forth have not long since been enlisted to devise and carry into execution a comprehensive system of transportation for the people.

The want to be supplied is of so definite a character that in devising a means of relief, the general conditions which will ensure success can be presaged with even a greater degree of accuracy than could the designers of the Croton Aqueduct determine its dimensions and source of supply, and it is not the part of wisdom (as some projectors have proposed) to carry into execution particular systems of construction whose several capacities to meet the pressing want must prove a matter of experiment. The impression exists to some extent in the public mind that the subject has received the most exhaustive attention of eminent engineering skill, and that any one of the several designs which have been so far sanctioned by legislative enactment would supply the necessary means of relief.

Nothing could be further from the truth. An association of individuals who purpose to undertake the construction of an important line of railway, involving intricate methods of construction, will naturally first make careful surveys and fix upon the most desirable route; then collect such statistics as will show the capacity required and the general features which govern the system of operation, and upon this basis prepare a complete design, for which they may then ask the necessary legislation with a reasonable hope of success. It has been thought proper, for some unknown reason, to neglect this course of procedure, which precedent has ordained as correct, in preparing designs for railways in the city of New York, and it does not appear that any of the companies who have brought their schemes before the public have called to their aid any considerable engineering skill, until after their charters were obtained, when, in each case, the designs have been found deficient in respect to route or capacity, the proposed method of construction inapplicable to some part of the given route, the cost excessive, or serious mechanical defects were apparent, and the remedy could not be applied. This condition of the case being understood, it may not be a matter of surprise and should not be a matter of regret that public confidence has not sanctioned the consummation of any scheme so far proposed. It is but just to except from the category of carelessly prepared designs that of the New York Railway Company, more familiarly known as the "Viaduct Company." This corporation expended no less than $100,000 in organization, preliminary examinations, surveys, plans, etc., and as a result were forced to conclude that their proposed method of construction involved too large an outlay to promise remunerative return. If, after reaching this conclusion, which probably few engineers will question; this company had endeavored to find a cheaper method of construction to which their proposed comprehensive system of operation could have been applied, they would in all probability have best subserved their own and the public interest; but as they would go through the blocks or not go at all, the opportunity still exists for doing what they left undone. If any association of capitalists will call to their aid one or more engineers expert in general railway work and bridge construction, submit to them the problem in all its entirety, and furnish a sufficient sum of money, probably fifty thousand dollars, for expenses of preliminary work, the resultant design will go far to dissipate the mystery in which incompetent treatment has so far enshrouded the transit question. There never has been prepared in the wide world a creditable design for an important engineering work, involving a question of transit or supply, except upon the basis of thorough preliminary examination and survey; and if this course be not adopted in devising a means of transit for the city of New York, it may be anticipated with a reasonable degree of certainty that what has been done in the past is a fair precedent for what will be done in the future, or that any actual results which may be attained will prove unsatisfactory in the highest degree. It must be borne clearly in mind that while it is probably now possible to devise and execute a system of transit sufficiently comprehensive to meet the wants of the city for many years to come, the consummation of a carelessly prepared design may forever preclude such possibility.

The methods of construction between which choice is to be made are essentially the tunnel, the viaduct or elevated way through blocks of buildings, and the elevated way in the open streets. The two former methods are, perhaps, so well understood as to require no especial explanation. It may not be amiss, however, to define the general specifications to which elevated ways of different designs should conform, in order to embody objectionable features in the least degree. An elevated way consists of a continuous line of bridges supported upon columns. Economical arrangement requires that these columns be located as nearly as possible under the loads which they support, and the least obstruction of the streets requires that they be small in size and few in number. Their position is further determined by the width of the street in which they are erected, the necessary arrangement being such that the transverse distance between any two columns, or between any column and the curb line, shall be equal to or a multiple of the width required for the free passage of the widest vehicle. Arranged in this manner, and with a longitudinal distance between columns sufficient to admit of diagonal driving, say fifty feet, it is difficult to see but that the full capacity of the street is retained for the use of vehicles. There is nothing to warrant changing the form of an elevated way from its otherwise economical and desirable arrangement, in order to secure architectural effect. This will generally take care of itself, those architectural structures possessing the most pleasing æsthetic effect which embody only such constituent parts as are reciprocating and sustaining. It is an essential requirement that an elevated way should have a preponderance of strength in all its parts, and to the end that it may be as far as possible a permanent way perishable material should be excluded from entering into its construction. The usual practice in bridge construction for ordinary railway purposes sanctions the use, and very properly, of wooden cross-ties. Care is taken upon well-conducted lines of railways that these shall be of uniform and sufficient size, be arranged at small intervals, and prevented from spreading by means of guard-timbers notched down and bolted. The reason is obvious. Bridges in which the cross-ties are loosely placed, at large intervals, or altogether omitted, would be dangerous traps if cars should be derailed in passing over or approaching them, and proper considerations of safety require that they be provided with floors which, in case of accident to rolling stock, shall be at least as safe as the aggregate of the line of which they form a unit.

In the operation, however, of a line of railway consisting entirely of bridges and constructed over crowded thoroughfares, there are other considerations which forcibly obtain. A tight floor, or even a floor of cross-ties, upon an elevated way will seriously interfere with the light and sunshine of the street, and, more than this, will collect snow and water, the dislodgment of which will be attended with discomfort if not danger to pedestrians and teams in the street. That these objections may be reduced to a minimum, the floor of an elevated way for city transit must offer the least possible horizontal area for the collection of snow and moisture, in other words, must be a narrow framework rather than a platform, an end which will be attained by omitting cross-ties, making the supporting trusses or girders of least possible width consistent with strength, and placing them one under the line of each rail. Accidents from broken wheels, axles, etc., can be guarded against by peculiarities in construction of rolling stock. It is simply a matter of detail and expense to do this. There will be, of course, some horizontal or lateral bracing, but this may be made very light. Bridge trusses placed in this position are termed in railway parlance "deck," to distinguish them from bridges in which the floor or track is attached to the lower chords, and which are termed "through." It is evident that in choosing "deck" rather than "through" bridges, the advantage of least horizontal area inheres in the former, as the latter must be of sufficient width to allow the passage of trains between the trusses, and must have both transverse and longitudinal beams to carry the rails. There are some other advantages which accrue to the adoption of "deck" rather than "through" bridges, principal of which may be noted the unpleasant sensation to passengers of passing rapidly in proximity the struts and ties of a continuous line of "through" bridges, and the difficulty of adapting depot accommodations to such a method of construction. Wherever the supporting columns stand within the curb lines, the superstructure should be so arranged that the cars will not overhang the sidewalks.

It may be generally stated, then, as suggested by the foregoing, that a successful design for an elevated way, independent of its detail, number of tracks, position in the street, etc., must conform to these general requirements:

No cross-ties.

Deck trusses rather than "through," and a minimum horizontal area of superstructure.

A preponderance of strength in all parts, and as far as possible the elimination of perishable material.

A minimum number and size of supporting columns.

Superstructure to be so arranged that cars will not overhang any sidewalk.

Within reasonable limits, the manner in which a line for city transit is operated, rather than its method of construction, will determine its character with the general public and influence their patronage or avoidance of it. The elements which will conduce to success are very clearly these: A route sufficiently comprehensive to be convenient to every part of the city; a capacity to furnish facilities equal to and increasing with the demand; a general system of receiving, carrying and discharging passengers to redound in the greatest possible degree to their comfort, safety and satisfaction; and last but not least, low fares.

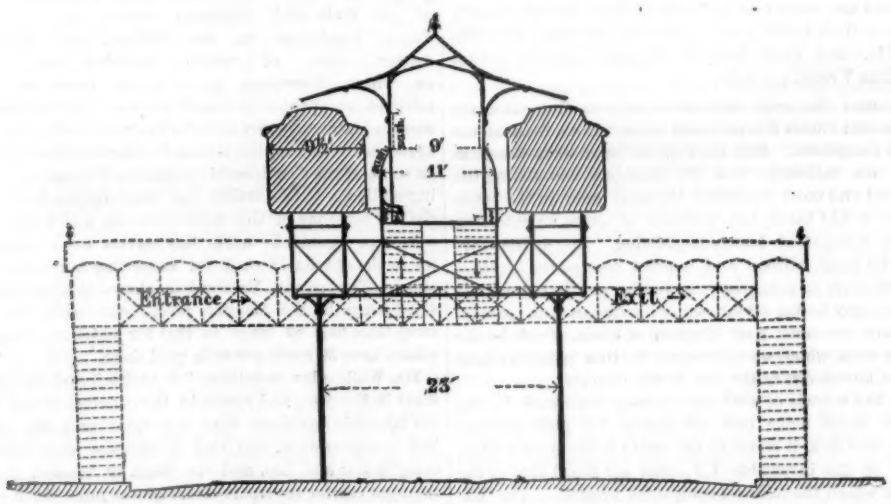
The method of construction is comparatively so minor a consideration, except as far as its cost controls the rate of fare, that it seems rather more in accordance with propriety, that if incomplete designs are to be sanctioned at all, charters should be given to proposed systems for operating trains over specified routes, and in a specified manner, leaving the method of construction to be determined by circumstances, rather than to charter methods of construction, and make all the more important details, such as capacity, character of depot accommodations, motive-power and rolling stock, and general system of operation, after considerations to be tacked on as best they may.

Let it be supposed that careful preliminary examination has shown that the present want for transit facilities will be

met by the construction of lines of railway between the Battery and One-hundred-and-fifty-fifth street (Carmansville), and that the amount of travel will furnish employment for four tracks. It has been generally purposed by projectors of four-track railways to use two tracks for through and two for local travel. This will not be found as satisfactory to a majority of the public, or to work the lines to as much advantage, as if all four tracks are employed in the same manner, as far as possible, to the accommodation of both through and local patronage, and this will be especially the case if the tracks are separated, two being placed upon each side of the city and connected at their extremities in such manner as to form a belt. The advantages of this form of location, both as regards covering a more comprehensive route, and affording increased facilities for the economical management of trains and the convenience of the public, need only be mentioned to be appreciated. When trains are run at small intervals of time, it will be unnecessary for any train to stop at all stations. Such an arrangement of stops as is represented in the schedule below will answer every purpose. Here every train stops at Battery, Fifty-ninth street, One-hundred-and-twenty-fifth street, and One-hundred-and-fifty-fifth street, and of every ten trains there is always one and generally two or more which carry passengers from any given station to any other.

A simple mechanical device at the stations will give passengers all necessary information, without requiring them to consult time tables:

		11 stops.	11 stops.	11 stops.	11 stops.	11 stops.	10 stops.	11 stops.	10 stops.	11 stops.	11 stops.
155th street	Sta	x	x	x	x	x	x	x	x	x	x
	Sta	|	x	x	x	x	|	|	x	|	x
	Sta	x	|	|	x	|	x	x	|	x	|
125th street	Sta	x	x	x	x	x	x	x	x	x	x
	Sta	x	|	x	|	x	|	x	|	|	x
	Sta	|	x	|	x	x	|	|	x	|	|
	Sta	x	|	x	|	|	x	x	|	|	|
	Sta	|	x	|	x	x	|	|	x	|	x
	Sta	x	x	x	|	x	|	x	|	x	x
59th street	Sta	x	x	x	x	x	x	x	x	x	x
	Sta	|	x	x	|	|	|	x	|	|	x
	Sta	|	x	|	x	x	|	|	x	|	|
	Sta	x	|	x	|	x	|	x	|	|	x
	Sta	|	|	|	x	|	x	x	|	|	|
	Sta	|	x	|	|	x	|	|	x	x	|
	Sta	x	|	x	|	|	x	x	|	|	|
	Sta	|	x	|	x	|	|	|	x	x	|
	Sta	x	x	x	|	x	|	x	|	|	|
	Sta	x	|	|	x	|	x	x	|	|	|
Battery	Sta	x	x	x	x	x	x	x	x	x	x
		1	2	3	4	5	6	7	8	9	10



The length of such a belt line as suggested will be approximately twenty miles. The time required to pass between the Battery and One-hundred-and-fifty-fifth street, at running speed of thirty miles per hour, with well arranged depot facilities, and in accordance with above schedule, will not exceed thirty-five minutes, which is certainly rapid enough for all practical purposes.

Little argument is requisite to show that the rapid carriage of a large number of persons over varying and considerable distances can be most economically and satisfactorily accomplished by means of cars running upon railways of standard gauge and locomotives generating steam by fires within themselves, as they go. If each car has a gross length of thirty-three feet and contains seats for forty passengers, it will be found as large as is consistent with being rapidly filled and discharged at stations. With due regard to length of stations, loss of time at some, and requisite weight of locomotives, probably the maximum train should not exceed ten such cars. Reasonable conformity to the surface of Manhattan Island will not permit the use of a limiting gradient of less than one in one hundred, while the minimum radius of curvature may not be greater than five hundred feet. This will require an effective locomotive weight of thirty-six thousand pounds, probably best distributed upon six driving wheels, to maintain a speed of thirty miles per hour upon the maximum gradient and with the given train. The depots for a railway doing such an unprecedented passenger business as will fall to the lot of well devised railways in the city of New York must be so arranged as to fulfil these general conditions, the method of construction of the railway conforming to the depot requirements rather than the latter to the former. Passengers must have ready access to the trains without necessity for crossing any track at the level of the rails. This requires either that a depot be constructed for each track of a double-track railway at each stopping point, or that one depot be placed between the tracks, at such points, and made to do service for them both. The latter is obviously the most economical arrangement, both in first cost of the structures, and in number of employes required to operate the railway; and it is believed that it can be effected in every case, whether the line is constructed over or under the surface. Each depot must be the full length of the longest train, and to obviate all unnecessary loss of time in receiving and discharging passengers must be identical with the platform, instead of consisting of waiting rooms and a platform. The entrance should be at the middle, to save passengers the necessity of traversing its whole length, as would to some extent be the case were the entrance at one end, and may be so arranged that each passenger in entering must pass a collector of fares as in the Ferry Houses. The exits, however, should be much more capacious and entirely distinct from the entrance.

If the distance between the inner rails of the tracks, at depot sites, is eighteen feet, advantage may be taken of a difference in elevation between the car and depot floors to provide a sufficient clearance of trains and give the latter probably a sufficient width.

The cross section below represents one way in which this may be done in some cases, where the method of construction is the elevated way or viaduct. The general arrangement in a tunnel would be the same, the arch in this case constituting the depot roof, and the entrance steps leading down instead of up.

The cost of such a depot, of full length of the longest train, say 350 feet, for either a tunnel or elevated way, and so constructed with sash and gates that it may be inclosed and heated or thrown into a comparatively open shed, may be $70,000.

It may be as well at this point as any other to suggest the rates of fare. These should obviously be as low as existing rates, and as low or lower than the rates over corresponding distances in any other direction. It is thought that the following will meet these general requirements and prove acceptable to the public:

Let it be supposed that Fifty-ninth street divides the railway lines into two divisions, and that the fares are, over one division or any part of one division, 5 cents; over two divisions or any part of two divisions, 10 cents; commutation over two divisions or any part of two divisions, 8 cents. The average of this, for purposes of present estimate, is assumed to be 7 cents.

In order to meet the requirement of accessibility of the lines to every part of the city, it will be necessary to construct and operate cross-town lines of street railway at intervals of about one half mile, at least below Fifty-ninth street. This will require approximately twenty-four miles of double track railway, which, with equipment somewhat similar to that now in use upon the Twenty-third street cross-town line and the necessary buildings, may cost $3,000,000. These street car lines should be operated as feeders to the railways, and while single fares may be 5 cents, fares in connection with railway tickets should not exceed 1 cent, and this should be done even to involve their working at a loss. The construction of a considerable number of cross-town lines, apart from their connection with longitudinal railways, will meet an existing and somewhat pressing want.

If 500,000 passengers per day represented the amount of travel upon Manhattan Island, or rather the patronage of the proposed railways, it is assumed that it would be disposed and could be accommodated by the arrangement of trains as indicated in the table below, although, in the absence of any known statistics bearing upon the relative proportions of travel at different hours of the day, the statement is entirely one of plausibility.

Public conveyances in the city of New York are now carrying a number of passengers somewhat in excess of 400,000 per day. It can hardly be doubted that a railway, more perfect in its appointments than any which the world has ever seen, as admitted by liberal estimates of cost, convenient of access, and operated for a low rate of fare, will divorce the larger part of a long-suffering but much-abused public from the primitive, slow, uncomfortable and uncertain modes of transit now in vogue; and it is perfectly within the limits of reason to estimate for the Utopian railway under consideration a patronage of 300,000 passengers per day. The public want will be most satisfactorily met by running fully as many trains as indicated in the above table, at which rate six cars per train will be sufficient to do the assumed amount of business. There will be required somewhat less than 500 cars and 170 locomotives, the daily service of the latter being assumed at 100 miles run. The cost of this equipment of locomotives and cars will not probably exceed $4,500,000. In round numbers, $4,000,000 per annum is the estimated cost of operating a double-track belt line of railway of twenty miles extent with ruling gradient of 1 in 100, furnishing capacity in assumed proportion to the demand, somewhat in excess of 300,000 passengers per day, but independent of any consideration of the method of construction, further than an allowance of $250,000 for renewal fund.

The total amount in addition to the item already stated is made up of an estimated loss of $500,000 upon the cross-town lines, of wages of all hands, car and engine supplies, repairs and renewal, renewal of rails, maintenance of way and buildings, superintendence and miscellaneous expenses, provides for the running of trains during every hour of the year, for a large complement of employees in every department, and is believed to include every known appliance conducive to the safety, comfort and rapidity of travel.

Four hundred seats per each train of ten cars:

		Number of trains per hour each track	Seating capacity two tracks. Up.	Seating capacity two tracks. Down.	Assumed travel two tracks. Up.	Assumed travel two tracks. Down.
5— 6 A. M.	Making all stops.	7	2,800	2,800	1,000	2,500
6— 7 "		13	5,200	5,200	2,000	5,000
7— 8 "		25	10,000	10,000	2,500	10,000
8— 9 "		30	12,000	12,000	3,000	12,000
9—10 "		30	12,000	12,000	4,000	12,000
10—11 "		25	10,000	10,000	5,000	10,000
11—12 M.		23	9,200	9,200	7,000	9,000
12— 1 P. M.		20	8,000	8,000	8,000	8,000
1— 2 "	Making half stops.	23	9,200	9,200	9,000	8,000
2— 3 "		25	10,000	10,000	10,000	8,000
3— 4 "		30	12,000	12,000	12,000	8,000
4— 5 "		30	12,000	12,000	12,000	8,000
5— 6 "		25	10,000	10,000	10,000	6,000
6— 7 "		20	8,000	8,000	7,000	4,000
7— 8 "		13	5,200	5,200	5,000	5,000
8— 9 "		13	5,200	5,200	5,000	4,000
9—10 "		13	5,200	5,200	5,000	3,000
10—11 "	Making all stops.	13	5,200	5,200	5,000	2,000
11—12 Midnig't		13	5,200	5,200	5,000	1,000
12— 1 A. M.		10	4,000	4,000	2,000	500
1— 2 "		5	4,000	4,000	500	500
2— 3 "		2	800	800	500	500
3— 4 "		2	800	800	500	500
4— 5 "		2	800	800	500	500
					125,000	125,000
Total for two tracks						250,000
Total for four tracks						500,000

It now remains to find a method of construction to which this comprehensive system of operation can be applied and admit the use of the assumed rates of fare, but before doing this it will be necessary to estimate so much of construction and equipment account as will be common and in addition to the cost of the railway proper. This will be:

Locomotives and cars	$4,500,000
40 depots	2,800,000
Cross-town lines	3,000,000
Yard room, engine houses, repair shops, water, oil, fuel and signal stations, say	1,000,000
Total	$11,300,000
300,000 passengers per day and half patronage upon Sundays, at average rate of fare of 7 cents, will yield a gross revenue per annum of	$7,119,000
From which deduct operating expenses	4,000,000
Net revenue	$3,119,000

Now if the investment is required to return a revenue of 10 per cent., it is evident that the total construction and equipment account must not exceed in round numbers $31,000,000, of which $11,300,000 have already been allotted to common expense, leaving $19,700,000 to pay for the construction of twenty miles of double-track railway. But little knowledge of the subject is necessary to warrant the conviction that neither a tunnel nor a viaduct of the given extent can be constructed for this sum. Upon the other hand three-quarters of this amount is sufficient for the construction of an elevated way of good design, and the remaining one-quarter is all that is required for the purchase of right of way, where conformity to the best route involves carrying the line through the blocks. Whatever may be the objectionable features inherent in the elevated way, all other methods must yield to it, not only in economy but in celerity of construction; and none other consults the comfort of its patrons by offering to such an extent, during transit, the advantages of pure air, sunlight and unobstructed view.

The favorable conclusions to which the foregoing discussion of the transit question tend should, perhaps, be received with some qualification, for while some of the principles laid down are incontrovertible, it is but the part of consistency to admit that the general results attained are based in part upon assumptions lacking the authenticity which only thorough surveys and collection of statistics can afford, and but little more is claimed for the scheme outlined in this paper than that it will serve to show how tangible is a knowledge of the elements which will constitute success in such an undertaking. If an association of prominent citizens or, as a last resort, the city or State will enter upon the collection of all available data, and the preparation of the most perfect design which can be devised, the practicability or impracticability of applying a comprehensive solution to the transit problem will be at once and forever determined. It is submitted that the issue at stake is worthy of the attempt. Upon the one hand the inconsiderable sum of money expended in preliminary work may possibly be unproductive in practical results; upon the other, and far more plausibly, the practicability of attaining the desired end may be demonstrated so fully as to enlist public confidence and warrant its consummation, to the enhancement of the social, political and commercial prosperity of this already great city.

SAML. BUEL, JR.

NEW YORK, January 5, 1874.

RAILROAD GAZETTE

Published Every Saturday.

CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

CONTENTS.

	Page		Page
ILLUSTRATIONS:		GENERAL RAILROAD NEWS:	
The Catechism of the Locomotive	33	Elections and Appointments	38
New York City Passenger Railroad	35	Traffic and Earnings	39
CONTRIBUTIONS:		Personal	39
Requisites of a New York City Passenger Railroad	34	Chicago Railroad News	39
Ticket Commissions—Something to be said for the Practice	37	Annual Reports	39
EDITORIALS:		Old and New Roads	39
The Pay for Postal Car Service	36	MISCELLANEOUS:	
A New England Bridge	37	The Catechism of the Locomotive	33
EDITORIAL NOTES	37	Meeting of the Master Car-Builders' Association	37
		American Tools at Vienna	38
		Discussion of Railroad Transportation	38
		Transportation in Congress	38

Editorial Announcements.

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

THE PAY FOR POSTAL-CAR SERVICE.

Our readers probably remember the efforts of some of the railroad companies with the Post-office Department and Congress last winter and Spring to induce an increase of the pay to be received for carrying those traveling post-offices called in this country postal cars. Some of them certainly do, for they have year after year, ever since such cars were introduced, stated their case to the Department or to Congress, or to both, proved incontestibly that they either were not paid nearly the bare cost of the service now, or else were enormously overpaid when the mails were carried in ordinary cars and are still paid most extortionately by ordinary customers for ordinary freight, have had their complaints acknowledged as just by all who examined the question at all intelligently, usually have succeeded in obtaining a recommendation from the Department in favor of better pay—and then have seen Congress quietly ignore the whole subject, or make some change which proved that its members had either not looked into the matter at all or did not care to do justice to corporations which most of their constituents regard with some jealousy. The subject is not likely to escape their memories, nor to fail to leave the feeling that our National Legislature, however quick to respond or make an appearance of responding to demands echoed by many voices, can be as inattentive and unready to do justice to an unpopular and in numbers insignificant interest as the most absolute and barbaric tyrant could be.

The testimony adduced last winter and spring must have convinced every man who had any reasoning powers and was not determined beforehand not to be convinced.

A certain compensation having been granted to railroad companies for carrying the *mails*, they were afterwards required to carry in addition *post-offices* and a force of clerks. Not only that, but they were required to supply those post-offices, to furnish them, to heat and warm them and to repair them; and then when they have asked pay for this additional service—usually several times greater than the original one—they have been put off year after year, and never have got any satisfaction or a reasonable prospect of any. Finally, having done the work for years for less than cost and used every exertion to get something like justice done them, when they announced that they must decline to do the work longer at a loss, they were abused as if they were rebels, and threatened with seizure and all sorts of penalties; and these threats have come from officials who could hardly help knowing the great injustice done to the railroad companies, but who also knew very well that the public and the newspapers generally would not study the question, and that in any contest with the companies to prevent an increase of charges they would have the sympathy of all the uninformed public—that is, probably ninety-nine hundredths of the people of the United States.

The grievance is not the same on all lines on which postal cars are run. But the extent of it on some railroads may be judged by the fact—very striking to every railroad man—that the payment is less for this service on the fastest trains than is received for carrying ordinary first-class freight on freight trains.

The great change introduced by postal cars is the necessity of carrying an unusually heavy and costly car for the conveyance of a comparatively small weight of mails. The Post-office Department receives accommodations for a car-load where formerly it had only transportation for a certain number of pounds of freight, which usually easily found room in the baggage car. Then, when 5,000 pounds of mail was carried, it required only one-third or one-fourth of a ten-ton car, and added with its share of the car not more than six tons to the weight of the train. The same load in a postal car (and one rarely carries so much), which of itself weighs fifteen to eighteen tons, increases the weight of the train by 17½ to 20½ tons, or three times as much as it did in the old way. Now it ought not to require any argument to show that the railroad companies should receive more for carrying eighteen than for carrying six tons, and no more to prove that an increase of one-half in the rate for the latter service is insufficient to pay for the former.

There is one class of service so very like the postal-car service as to serve as a fair standard of comparison. This is the express service. In both, the service of the railroad company is almost solely the hauling the cars, which are loaded and unloaded by the hirer, who also relieves the carrier from responsibility for the freight carried, though postal-car clerks can recover for injuries, which express companies' employees cannot do. Now the express companies pay from 50 to 71 cents per mile on the roads on which most postal cars run, while the same companies for running and supplying the postal cars (which cost several times as much and are much heavier in themselves, though usually lighter in their loads) receive generally less than 20 cents per mile, and until last year on some lines received not more than 7 cents per mile.

Of course the only alternative here is, that either the Government cheats the railroads or the railroads cheat the express companies. Now the express business is almost as old as the railroads, and its managers are among the shrewdest and most successful business men in the country, who would hardly have suffered so gross an extortion so long without at least complaining. But as there are some who lump railroad and express companies together as extortioners in conspiracy, it will be well to consider as nearly as may be the actual cost of moving cars on passenger trains on some road or group of roads, which by the way is a work which we enter upon at this point without the least knowledge of the way it will turn out.

If we had reports of working expenses sufficiently in detail, we could make this calculation for each road aggrieved, and this, it seems to us, would be the proper plan, instead of the invariable 1.3 cents per lineal foot of car per mile which the railroad companies propose. The latter plan, however, has the advantage of simplicity—a great advantage in dealing with men of a certain degree of stupidity.

For this purpose we will take the statistics of the Massachusetts railroads for the year ending September, 1872 (statistics, by the way, which American railroad men could afford to pay a great deal of money for, if the State of Massachusetts did not supply them free), in the "Tabulated Comparative Results" of which (published in the RAILROAD GAZETTE of March 15, 1873, page 109) will be found a statement of expenses per train mile for each road in the State, and the average for all. The average expense was $1.31, this of course not including anything as interest on the capital invested. Not all the items of expense are given on both freight and passenger trains, but repairs of cars and wages are, and amount to 44.1 cents for passenger and 47.5 cents for freight trains. If the other expenses are proportional—and they are probably not far from it—the average cost per passenger-train mile in Massachusetts was $1.26. To find the average number of cars per train we will have to make some calculations; but as we find by the reports that there were 1,122 passenger-train cars at the beginning of the year and 1,331 at the end of it, making an average of 1,226½, and that each of these cars ran on an average 25,961 miles, multiplying the last two figures together will give us the passenger-train *car* mileage, which is 31,841,166. Now by dividing this by 7,713,478, the passenger-*train* mileage, we have the average number of cars per train, which is 4⅛ very nearly. Now dividing the $1.26, the average cost per passenger-train mile, by 4⅛, the average number of cars per passenger train, we have 30½ cents as the average cost per mile of transporting a car in a passenger train. The average net income of the Massachusetts railroads for that year was at the rate of 6.3 per cent. on the capital invested, which probably will not be thought an extortionate profit, and so we may consider the average *receipt* per passenger-train mile as reasonable. This is $1.67, or 40½ cents per car, just a cent and a half more than the railroad companies ask for hauling postal cars 30 feet long, which are doubtless somewhat heavier than the average New England passenger-train car.

It is not on the "average road," however, that postal cars usually run, and perhaps we will do better to take an example from among lines on which they are actually run. The Boston & Albany, of the Massachusetts roads, will serve as an example. On this the average expense per passenger-train mile, calculating as before, was $1.75, the average number of cars per train 5.47, and the average cost per car per mile 32 cents. The average *receipt* per car per mile was $2.37÷5.47=43⅓ cents.

A similar calculation shows for the Connecticut River road (on which only a part of a car is used as a postal car), expenses per passenger train car per mile 24 cents, and receipts 35 cents.

It seems to us that it is on a basis something like this that the pay for this service should be fixed. The transportation cannot in any way be compared with freight service. It is almost exactly similar to express service, and the expense of it must be found from the cost of running passenger trains. This is information which ought to be attainable from every company. The service is one which can afford to pay well—that is, the matter transported is of extraordinary value, and would continue to be carried were the cost several times as great, as, indeed, it used to be before the days of railroads. It in justice ought to pay not merely its proportion of the expense of the trains which it uses, but also its full proportion of the interest on the capital invested. If it does not, these expenses become in reality a charge on all the other traffic which pays more than expenses, or a special tax on the proprietors of the road; and however desirable it may be to keep down the cost of carrying the mails, it certainly is not right to do so by making ordinary freight and passengers pay it.

Mr. David A. Wells has recently published an interesting pamphlet in which are collected many of the most striking of the facts and arguments which have been adduced heretofore on the subject, and much new matter, some of which describes the methods in which European governments treat with their railroad companies for mail service. In England, it is shown, if the company and the Postmaster-General cannot agree as to terms, the matter is submitted to arbitrators. In some of the Continental countries the service of carrying mails on certain trains has been imposed as a sort of charter tax—one of the conditions on which the companies were organized—while any service not so contracted for in the charter is paid for according to mutual agreement. The pay in England is shown to have been 54 to $1.22 per mile, the English postal car being very little more than half as large as that for which our companies ask to have 39 cents per mile paid them.

Mr. Wells also considers the authority of the Government in the case, and comes to the conclusion that it may not take this any more than any other property without just compensation, and that it has the same claim that every individual has, and no other, to demand that any common carrier transport its freight at rates which are not extortionate.

It ought not to be necessary to say a word as to this. No sane man can believe that the Government has the right to confiscate the property or the use of the property of any individual or corporation. The Government and every individual under it are entitled to have the services of railroads and other common carriers by paying for them, but the Government has in this case no more nor other rights than the individual.

The present rates for transportation of mails (by act passed last year) have a double basis. There is a payment per mile of road varying according to the average weight transported, and an additional allowance when the whole of a postal car is used, varying according to the length of the car (not proportionally, but in a larger ratio than the length). These extra allowances are about equivalent to 4 cents per mile run for a car 40 feet long, 4.8 cents for one 45 feet long, 6.4 cents for one 50 feet long, and 8 cents for one 55 to 60 feet long—in one case an increase of one-ninth in the capacity of the car being accompanied by an increase of one-third in the allowance for it. The sufficiency or insufficiency of these allowances depends altogether on the average weight of mails carried in them, though the expense hardly varies appreciably whether one pound or five thousand are carried, for an ordinary train would not be more than one-sixtieth heavier with the 5,000 pounds of mail than without it. Now Mr. Wells' pamphlet says that under the new law the amounts paid to the Pennsylvania, the Philadelphia, Wilmington & Baltimore and the Boston & Albany are at the rate of 12 to 19 cents per 30-foot car per mile, which is less than the cost of hauling passenger-

train cars on any road in the country, probably, unless it may be where they run very slowly.

We cannot but feel, however, that the indisposition of the Government to increase the compensation is not due so much to any difficulty in understanding the justice of the claims as to utter indifference about doing justice to unpopular claimants, when such action on the part of Congress and the administration is not likely to win favor from the mass of the people.

A New England Bridge.

The iron bridge at Waterbury, Vt., on the line of the Central Vermont Railroad, which has recently been built by Mr. E. H. Hewins, of Boston, is over a very dangerous stream, the Winooski River, which is so situated between the mountains that quite ordinary rain storms cause a very material rise in the river, which, together with the fact that this bridge has been erected during the unfavorable weather of winter—the thermometer having indicated as low as 22° below zero—illustrates forcibly the superiority of the details of construction as used in American structures over European methods; in fact, it would have been practically impossible, except at an enormous expense, to erect this bridge at this season of the year, had it been built upon the lattice or plate girder systems.

This structure was erected without interrupting or delaying a train more than a few minutes. There was originally at this place a wooden bridge about 430 feet long in three spans, which was burned in June, 1873. The railroad company immediately built a temporary trestle work, their organization of forces being such that trains were interrupted only two or three days, though the timber for building it had to be cut in the forests. Since that time the trestle work has been carried away twice, one of which times one of the iron spans was greatly endangered, being at that time partly on the staging.

The bridge is built upon the general plan known as the Pratt truss, of wrought iron, except the necessary connecting and joint blocks, which are of cast iron. At all intersections are pin and screw connections. The bridge is proportioned to carry a load of 3,000 lbs. per lineal foot exclusive of the weight of the structure, and straining the iron in tension a maximum of 10,000 lbs. per square inch, and in compression 6,500 lbs., allowing for the length of the strut. The compression members are in each case composed of pairs of I beams thoroughly united to form a unit. These beams were rolled by the New Jersey Steel and Iron Company, and were assumed to be of their usual high standard of excellence. The bar iron was required to have an ultimate strength of iron from 50,000 to 60,000 lbs. per square inch, with an elongation of not less than 15 per cent., and to have a limit of elasticity of from 25,000 to 30,000 lbs. per square inch. To insure this standard, one or more bars from each lot was selected at random and tested till its failure. After each bar was finished and ready to ship it was tested to 15,000 lbs. per square inch, and the number of tons to which the bar was subjected stamped on the bar near the center of its length. These tests were made with much care in a machine which indicates by levers, and is of sufficient strength to break the largest bar. Careful attention was given to observe and record the amount of elongation of each bar for each 5,000 lbs. strain per square inch, and also to observe if the bar recovered its original length, a failure to do so causing its rejection. By this test it can readily be determined if the different bars are uniform in ductility or toughness.

The first span was completed and trains commenced running on it the morning of December 15, 1873; the second span December 29, and the last span January 5, 1874—just four weeks from the day the first iron was on the first span, including considerable lost time from stormy weather.

THE COST PER TON PER MILE, aside from charges on account of capital invested, of carrying freight on the New York Central & Hudson River Railroad and the Lake Shore & Michigan Southern, according to the reports made to the State of New York for the year ending with September last, was almost exactly the same on both, and amounted to 0.95 cent. More exactly it was 0.9544 cent on the Lake Shore and 0.9499 on the New York Central. The average receipts was 1.57 cents on the Central, the working expenses being 60½ per cent., and 1.37 cents on the Lake Shore, with working expenses 69⅝ per cent.

HEAPING COALS OF FIRE ON AN ENEMY'S HEAD—in the scriptural and metaphorical, not the literal sense—is not a common practice among rival railroad companies; nevertheless we read that the Boston & Maine directors have been doing something of the kind. Through travel on the Eastern road being stopped by the burning of a bridge that will take ten days to replace, the Boston & Maine board promptly passed a resolution offering to haul the Eastern passenger trains from North Berwick to Portland free of charge. Perhaps after all the motive may not have been unmixed benevolence and good will to a rival, but the thought may have occurred to some of the board that now was a good time to put in that connecting switch at Portland.

Ticket Commissions—Something to be Said for the Practice.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have been interested in perusing in your paper the conversation between the English director and the American Superintendent on the subject of commissions, as reported by "Hindoo," and, being one of the *paying* parties, would like to say a few words on the subject, in a modest way, acknowledging my youth and inexperience, and merely setting forth the appearance of the matter to me individually.

To begin with, I suppose that, notwithstanding the "sops" thrown to the ticket-agents throughout the country, in the way of comforting circulars, annual passes, disclaimers of evil intentions and the like, there can be no doubt that the managing power of *every* railroad in the country is opposed to the payment of commissions, providing it is for the advantage of the roads they represent—in other words, if they can lessen their expenses without diminishing their receipts they would "jump at the chance." Expressions of love and veneration for the ticket agents, as they must fully comprehend, are called forth by the hope of future favors alone, and the recent efforts on the part of some roads to curry favor by statements to the effect that they are unqualifiedly in favor of the continuance of the commission system are simply specimens of what is currently known as "cheap talk." The whole question with the roads is "does it pay?" and on this question hinges whatever action has been or will be taken in relation to the system.

I think that in *some* cases it *does* pay. As to the general question, whether as a whole the companies are benefited by it, I entirely agree with the sentiments expressed in the conversation to which I have referred, viz.; that it is simply a tax on the resources of the roads, with no adequate return.

Yet there are some things to be said on the other side. A large number of the Western tickets sold in the East and the Eastern tickets sold in the West are sold by agents who receive no pay for such service, but are simply local agents of short lines, having an interest of but a few miles of the long distance over which the tickets reads, and the only compensation received by such agents for the care of a large stock of "through" tickets, and the trouble and risk of handling large sums of money therefor, is the commission paid them by foreign roads. It is true that, should the local agent furnish the passenger a local ticket to the end of his road, or to the first competing point, the passenger must there buy his through ticket, and *may* do so by the same route as if he had bought at the starting point; yet passengers as a rule have prejudices in favor of through tickets, and thus to some extent the commission system inures to the benefit of the traveling public. Still further, the "Great West" is *terra incognita* to very many inhabitants of the Eastern States, notwithstanding multifarious maps and railroad guides, and such persons, proposing travel, go to the station for information as to the best routes. To the credit of the agents be it said that they rarely favor the line that pays the largest commission, if by so doing they send the passenger by any other than the best and shortest route. With *no* compensation for giving such information, and with the usual duties of station agents to attend to, the information obtained by the traveler would be meagre, perhaps not from lack of courtesy on the part of the agent, but simply from the fact that, having no interest beyond his own line, he would take no pains to keep himself well informed. In this way again does the public derive indirect advantage from the commission system. That the system as at present organized (or *dis*-organized) should at once be submitted to an extensive *pruning*, all will agree; but having a constitutional aversion to asking *something* while returning *nothing*, I cannot bring myself to look with entire favor on its complete abolishment, nor do I see how such abolishment can be permanently effected. So long as one of two competing lines is, for any reason, *weaker* than the other, just so long will it be obliged to *buy* its business or go without it; and just so long the stronger will be obliged to meet, or partly meet, the inducements held out by its rival, in order to hold its own. If the roads would pay more attention to the cutting down of their *advertising* bills, it would save (in many cases) more than would be gained by the abolishment of commissions, and with *no loss of business whatever*. For of all the follies ever perpetrated by railroad companies, that of yearly issuing thousands of elaborate "half-sheet cards" and hundreds of gorgeous, pictorial "bulletin boards" and employing men to traverse the country and *shingle* depots and walls with the same, is the most supreme.

As I have intimated, I *pay* commissions but receive none, and consequently have no personal interest in the perpetuation of the system. I have simply given my own impressions on the subject as conceived in so conservative a locality as

BOSTON.

Meeting of the Master Car-Builders' Association.

The usual monthly business and social meeting was held at the rooms No. 113 Liberty street, on Thursday evening, January 15. About 20 or 30 persons were present. Owing to some misunderstanding, Mr. Leeds, who was expected to address the meeting, was not able to be present, but sent his regrets by telegraph, and proposed to fulfil his engagement at the next meeting.

Mr. Allen, of Philadelphia, was then introduced by the Chairman, Mr. Van Houten. Mr. Allen said he expected to be present more as a listener than as a speaker, but in the absence of Mr. Leeds he would present his own views regarding ventilation. He stated that the most deadly gases fall, and the disagreeable odors rise, and that the impure air should be exhausted from the floor, and showed some diagrams showing the effect of admitting warm air at the floor and allowing it to escape at the top of the room, and also the effect of exhausting air from the floor. In hospitals a larger number of typhoid patients recovered when the impure air was exhausted from the floor than when it escaped from the ceiling. It is said that hot air is unhealthful, which is not true. Air heated to a high temperature absorbs more water than cold air, and therefore it is too dry, so that large quantities of air should be warmed to a comparatively low temperature instead of heating a small quantity until it is very hot. The pleasantest way to warm air is to pass it over hot-water pipes, but such pipes at the floor of a room heat the impure air, which then rises and is breathed. He showed a plan for warming cars with a stove underneath the cars, which is in use on the Reading Railroad. The warm air is introduced at the bottom of the car and is also exhausted from the floor.

Mr. Baker, of the firm of Baker, Smith & Co., asked why hot-water pipes were unwholesome.

Mr. Allen replied that any radiating surface at the floor was objectionable.

Mr. Baker said that a room in which a surface of 200 square feet of hot-water pipes were needed to warm it, could be and was heated with only 50 square feet of ordinary stove-heating surface, thus showing that the latter must be very much hotter than the hot-water pipes, and consequently the air which comes in contact with the stove must be heated to a much higher temperature than that which is warmed by the pipes. Air heated to a high temperature becomes very dry, and is therefore objectionable to people with weak lungs. Hot-air furnaces he believed to be one of the most prolific causes of death known. Besides, heating cars by a current of hot air is not reliable, as no air could be taken into a car when the wind is blowing in the same direction and speed as the car is running.

Mr. Chamberlain, of the Boston & Albany Railroad, said that that is not a supposable case, as the wind does not blow nor the cars run at exactly the same speed for any length of time; they are both constantly varying in speed.

Mr. Baker said the best heater is a radiating surface distributed over the floor, which keeps the feet warm; then open the ventilators with this arrangement and allow the fresh air to circulate through the car and thus keep it pure.

Mr. Creamer, of New York, had nothing to say about heating, but would only speak of ventilation. A car must be heated and ventilated at all times, day and night, and therefore it should be done in the simplest possible way. It must be ventilated moving or standing still. In order to do this, suitable apparatus must be provided for admitting air. It will be found that when the cars are in motion the smoke will often fall and follow along the raised roof, and the dust from the track does not rise above the windows, so that the only place that is clear of both smoke and dust is the frieze, or the portion of the sides of the car between the windows and the cornice. Mr. Garey's plan admitted smoke. Air must be exhausted if it is admitted, which can be done by his automatic deflectors.

Mr. Allen.—The conditions of ventilating a car are the same as for a room. If you put an ordinary stove pipe with both ends open, the one near the bottom and the other above the roof, even without a cowl or top to it, it will create so strong a draft as to draw newspapers up. If the impure air at the bottom is heated, it will rise, and if Mr. Baker will only add a bottom ventilator it will improve his heater.

Mr. Forney said that he regarded all ventilation as the old toper remarked about rum. He (the toper, not Forney) said it was a mistake to say that there was such a thing as bad rum; all rum was good: the only difference being that some rum was better than some other rum. So he (Forney, not the toper) regarded all ventilation as good, the only distinction being that some plans of ventilation are better than others. He also called attention to the fact that the system of bottom ventilation, as it was called, or that of exhausting the air from the bottom instead of the top of a room, was the plan adopted by Ruttan ten or twelve years ago in his method of warming and ventilating cars and houses. He knew from his own experience that exhausting the impure air from the bottom *alone* was not effectual in removing all the impure air. As has been said, the odors and especially the sulphuretted hydrogen which escape and are exhaled from the body rise, and must be exhausted from the top. He also called attention to the fact that great care must be taken in arranging the flues to exhaust air from the floor, as if there is an opportunity for air to escape from an aperture at the top of a room, there is great danger that the ascending current in the exhaust flue will be reversed, and that cold air will be admitted at the floor instead of being exhausted. He thought, however, that, for cars, exhausting air from the floor served an excellent purpose, as it removed the cold air and such impurities as do not rise. He would therefore recommend the use of an exhaust shaft with an opening at the floor and a hood or cowl on top, which would turn with the wind so as to insure having the current exhausted from the car, and not reversed so as to admit cold air. As this arrangement could not at any time be a cause of discomfort to passengers, he would arrange it in such a way that it would be impossible to close it. At the same time a car should be provided with exhaust ventilators at the top, which might be opened or closed as desired. The chief difficulty in ventilating cars is not, however, in exhausting the air, but in admitting it, and usually there will be no trouble in allowing it to escape if we can only take it in without making a car uncomfortable.

Mr. Ward, of the Pennsylvania Railroad, said that Ruttan came to Altoona some years ago, and went into the paint shop, which was heated with a number of large stoves. The smell of varnish was very bad and extremely oppressive, and the men were frequently made sick from it. Ruttan proposed to heat it by placing a stove at each end of the shop, and attaching thereto a flue for admitting air which was heated by the stoves, and the other flues for exhausting air from the floor. This was done, and in this way the building was heated perfectly and all offensive smell of varnish was removed. He also said that Ruttan's plan of ventilating cars was in use on the Philadelphia, Wilmington & Baltimore Railroad. The windows of these cars were so arranged that only a small section could be opened. The result was that in summer, when the cars stood still, the heat became very oppressive, and passengers would not ride in them if they could avoid it.

Mr. Chamberlain described some experiments he had made, and some plans he had used on his road, the result of which led him to conclude that the best position for ventilators to admit air is at the front end of a car, and for exhausting it, at the back end.

The discussion then became general and was taken up by Messrs. Baker, Creamer, Garey, Leighton, Adams and Chamberlain.

JOURNAL BEARINGS.

The subject of journal bearings was then announced as being in order.

Mr. Hopkins, of New York, described his patent journal-bearing, which consisted of a cast-iron case or shell in which the friction metal was placed. The latter was then coated with a thin lining of ordinary soft lead, the object of which was to allow the bearing to adjust itself at once to the journal. This prevented heating when the bearings were new, and wore a long time.

Mr. Partridge said he had recently found twenty different kinds of bearings were required on one road for repairs.

Mr. Little, of Philadelphia, wanted information about the best kind and form for car journal-bearings. He thought a good brass bearing was better than any softer metal.

Mr. Ward said that at one time the Pennsylvania Railroad used Babbitt's metal at the back end, and not at the front end of their bearings. He found then that the journals wore most on the Babbitt's metal bearing.

Mr. Hopkins recommended a mixture of 6½ parts of copper, 1 of tin and about 1 ounce of zinc to 50 lbs. of composition.

Mr. Garey, of the New York Central & Hudson River Railroad, after 27 years' experience, thought the best results were produced with a composition of copper and tin, and said that he had been told there was a great difference in the wearing qualities of different kinds of tin.

Mr. Little said the parties with whom he was engaged find only a slight difference in the wearing qualities of tin, but there was also a difference in the wearing qualities of different kinds of copper.

Mr. Garey.—Would you advise using old journal bearings?

Mr. Little.—Yes; a small proportion of old brass. The great difficulty is that many moulders do not know how to heat and mix metals.

Mr. Hopkins.—I can use any metal, even cast iron, and it will wear well with a lead lining. Journals change in form; and unless you have a soft metal it will not adapt itself to the

journal. In order to have perfect lubrication, there must be considerable surface; otherwise the oil will be forced out.

Mr. Adams.—What is the effect if a solid brass is heated on the road?

Mr. Little.—Poor material will cut, but good composition can be cooled and will then do well.

Mr. Adams.—Does not brass become brazed fast to the journal, so as to tend to twist off the journal?

Mr. Garey.—I have never seen more than one instance of that kind; in that case the car was burned up.

Mr. Adams.—I can show a number of cases in which the brass is twisted around the journal.

Mr. Hopkins.—Poor brass with much zinc in it melts at a low heat, whereas brass which melts at a higher temperature becomes heated so high that the one becomes brazed to the other, and the phenomena described by Mr. Adams occurs.

Mr. Smith said the Erie Railway had used the lead-lined bearing, but abandoned it last May. Since then the number of hot boxes and the attending expense had increased very much.

A motion was then made and unanimously carried, inviting Mr. Leeds to address the Association on the subject of ventilation at the next monthly meeting. Adjournment followed.

[We will add that Mr. Leeds has since then consented to address the Association at their next monthly meeting, which will be on February 19.—EDITOR RAILROAD GAZETTE.]

American Tools at Vienna.

Although the display of American tools and machinery at the Vienna Exposition was very meagre, those which were shown seem to have made an excellent impression. Mr Corliss, though he exhibited no engine, received a grand diploma of honor, the highest premium, for his celebrated steam engine. A similar distinction was given to William Sellers & Co., of Philadelphia, for a large and fine collection of machine tools. The recommendation of the jury in this case was given in these words:

"*Sellers.*—For pre eminent achievements in inventing and manufacturing machine tools, which in part have served as models for the manufacturers of all countries."

This and other firms made large displays of machinery at the Paris Exposition in 1867, which were sold abroad. Upon these tools Professor Reuleaux, Director of the Industrial Academy at Berlin, reported as follows:

"Upon the field of inventions and of inventive genius, there were but few highly remarkable achievements present, and among these America held the first rank. Her machine exhibition bore almost exclusively the character of originality, and, although the execution was not generally superior, it contained examples of the highest order of constructive ability and perfect workmanship." "France and England offered less original matter—more than both perhaps Germany and Switzerland."

"Upon the whole it may be said that in machine industry England has partly lost her formerly undisputed leadership, or that she is at least about to lose it. The healthy young trans-atlantic industry, which continually withdraws from us energetic and intelligent heads and robust hands, makes, with the aid of her peculiar genius, the most sweeping progress, so that we shall soon have to turn our front from England westward."

"Newly devised motors, forming part of complete machines and models of distinct parts, exhibited as novelties or inventions, were numerous. In the first direction Sellers & Co., of America (Philadelphia), have accomplished the most. The constructions of Sellers, some of which have very rapidly made their way through Germany, bear, in regard to invention, the peculiar, unique stamps of American genius. They are distinguished from us by more direct and rapid conception. The American aims straightways for the needed construction, using the means that appear to him the simplest and most effective, whether new or old. Our historically heaped up material and the cautious character of the German are so inseparably interwoven that among the number of known means we often forget to ask whether they are the simplest or whether new ones might not be better. The American really constructs in accordance with the severest theoretical abstraction; observing on the one side a distinctly marked out aim, weighing on the other the already available means or creating new ones, and then proceeding, regardless of precedents, as straight as possible for the object. The spirit is manifest in Sellers' lathes, shaftings and bearings, in his planing machine with diagonal screw shaft, in his screw-cutting machine; and it is strikingly prominent in his system of screw threads, which he has boldly placed alongside of the old, venerated Whitworth system, in spite of the terror of its numerous adherents, after he had discovered actual deficiencies. A proper valuation of this proceeding contains the most instructive hints for our higher technical institutions."

Engineering (London, August 29), under the head of "Machine Tools at the Vienna Exposition," speaks as follows:

"Leaving the American collection, and passing on to the British section, we cannot but be struck by the different character of the exhibits. In the American department almost every tool possesses some novel feature, and each is distinguished by an individuality which shows it to be the special design of its maker; while in the British section the great majority of the tools are reproductions of the old and well-known patterns, possessing scarcely any interest whatever as exhibits." Describing in detail certain English tools, mention is made of "one of Sellers' planing machines, with the driving pulleys arranged at right angles to the position given to them by Messrs. Sellers themselves, and some Sellers' screwing machines." Regarding this planer we shall have more to say hereafter. Again, in speaking of some Swedish machines, the writer says: "These tools are well made and of good design, but the patterns have a strong appearance of having been to some extent copied from American originals. The countershaft of the lathe, we notice, is carried by hangers of Messrs. Sellers' type, and in place of shifting the belts, friction clutch pulleys, of the pattern made by the Brown & Sharpe Manufacturing Company, of Providence, U. S., are used for stopping and starting. In pointing out these facts we by no means desire to disparage Mr. Munktell's exhibits; the expedients adopted are good, and they deserve to be used in Sweden as well as in America."

Commenting on the above, the *Journal of the Franklin Institute* says:

"Although a high order of merit is thus recognized in all the exhibits of American tool makers, the special honor conferred upon William Sellers & Co. leads us to take their work as a prominent example of American ingenuity, and as showing something of the influence it is likely to exert in the world at large. To aid us in considering this subject, we have before us an illustrated catalogue of machine tools entitled 'A Treatise on Machine Tools as made by William Sellers & Co., Philadelphia.' This work, a neat duodecimo, is profusely illustrated by photographs and wood engravings, and contains not only a description of the various machines made by this firm, but also many of their ideas in regard to the use of tools and the general management of shops.

"An examination of this book in connection with the Vienna award to this firm, and the favorable comments of our foreign contemporaries abroad, seems to call for more than a mere passing notice.

"To make any machine of even moderate complexity, machine tools, such as lathes, planers, drill presses, etc., are essentially requisite. All branches of mechanical industry are dependent upon the machine-tool builder for their possible existence, save in the crudest form. Without machine tools, the steam engine and the power printing press would be impossibilities; and without them modern civilization could not exist. In the manufacture of these important tools, America seems—if we may judge from the flattering comments of the foreign press, and the increasing market which American tools find abroad—to be taking the lead, and that apparently because of the peculiar excellence of principle and novelty of design exhibited by American machine tools."

* * * * * * * *

Indeed, the very principles and theory of American machine construction bears witness to this; no opportunity is lost to save a useless step, an unnecessary motion. Writers on the subject remark that Americans try to arrange their machines so as to make them the most convenient for the workman. The planing machine for iron made by Messrs. Wm. Sellers & Co., is one of the tools that attracted the most attention abroad, and in referring to their book we find the following, in a description of this machine, extracted from the *Practical Mechanics' Journal*, London: "Most conspicuous and important among the various novel features of this machine is the manner of giving motion to the table. This is furnished with a rack, but instead of being operated by the ordinary spur-gearing, it receives motion through a peculiar form of spiral pinion upon a driving shaft which crosses the bed diagonally, and passes out in the rear of the upright, on the *side where the workman stands*. (The italics are our own. ED.) This shaft is driven from the pulley shaft by means of a bevel wheel and pinion. The position of the pulley shaft *places the driving belt within convenient reach of the operator*, and its axis being parallel with the line of motion of the table, these machines may be placed parallel to lathes, and thus economize space and permit a better arrangement of the workshop." In noticing the Sellers' planer reproduced by an English house, as mentioned in our extracts from *Engineering*, it is further said, it has the pulleys arranged at right angles to the "position given them by Messrs. Sellers themselves."

Nor is this all; one of our correspondents, an active member of the Franklin Institute, just returned from abroad, tells us that the pulleys are not only placed at right angles to the line of motion of the table, but on the opposite side of the machine, entirely out of reach of the workman. Struck with this apparently unaccountable change, he at once inquired its reason, and was told that the pulleys were so placed because British workmen *were used* to having pulleys put in this position. Here we see a clearly demonstrated advantage in an American invention set aside, as it seems to us, to satisfy the unthinking prejudice of the so-called "practical workman." These workmen's prejudices always retard progress, and we fear are more likely than anything else to prevent a full appreciation of the spirit of American inventive genius in lands where tradition rules.

Discussion on Railroad Transportation.

At the evening meeting of the American Society of Civil Engineers to be held February 18 next, a discussion is to be had on the elements of the cost of railroad transportation, and details under the following heads are requested:

PASSENGER TRAFFIC.

1st. What are the various elements of the cost of passenger traffic distinguishing if possible, between through, local and suburban business?

2d. What are the usual or the possible proportions between the number of seats carried and passengers transported one mile, on various lines?

3d. What are the weights of passenger cars per seat carried, and what is the proportion of dead weight of passenger trains, per seat and per passenger transported on various lines?

4th. To what extent is the cost increased to paying passengers by the practice of giving complimentary passes, and by paying commissions upon tickets sold?

5th. In what manner, and to what extent, is the cost of passenger traffic affected by gradients and curves?

6th. How is it possible to secure greater economy in the transportation of passengers, without materially reducing the accommodation demanded by the public?

FREIGHT TRAFFIC.

1st. What are the several elements of the cost of transporting freight, distinguishing between those which increase in proportion with the traffic, and those which are arbitrary or nearly so?

2d. What are the circumstances of location, construction or traffic which cause a greater cost of transporting freight per ton per mile on one road than upon another?

3d. What is the difference of cost of each of the various classes of freight as generally divided in freight traffic?

4th. What principles are generally adopted, or should govern, in making up freight traffic?

5th. What are the proportions of dead weight and paying loads on various lines, and to what extent do they affect the aggregate cost?

6th. In what manner, and to what extent, is the cost of transporting freight influenced by the grades, curves or peculiarities of construction?

Transportation in Congress.

In the Senate on the 21st:

Mr. Ingalls, of Kansas, introduced a bill to incorporate the Colorado & New Mexico Railroad Company, and granting the right of way over the public lands. Referred to the Committee on Territories.

In the Senate on the 22d:

Mr. Morton, of Indiana, submitted the following resolution, which was laid on the table and ordered to be printed:

Resolved, That the Committee on Transportation Routes to the Sea-board be instructed to consider and report a bill creating a commission of five eminent and skilled persons to be appointed by the President, by and with the advice and consent of the Senate, who shall examine and report to Congress what legislation is necessary and practicable in regard to inter-State railroads to promote the following objects, viz.: The speedy transportation at reasonable rates of freight and passengers; the safety and comfort of passengers, by providing for the inspection of bridges, tracks, locomotives and cars, and the reform of any abuses that may exist in consequence of extortion, or unjust discriminations in the transportation of freight and passengers, and, in general, what regulations are necessary to promote the efficiency of railroads, the interests of commerce, and the convenience and safety of the traveling public.

In the Senate on the 23d:

Mr. Allison, of Iowa, presented petitions from citizens of towns on the lines of the Chicago, Clinton & Dubuque and the Chicago, Dubuque & Minnesota railroads, asking that the Clinton Bridge of the Chicago & Northwestern Railway be opened to all railroads desiring to use it. Referred to the Committee on Commerce.

Mr. Wright, of Iowa, introduced a bill to provide for cheap transportation by way of the Great Lakes. Referred to the Committee on Transportation.

The bill giving the Secretary of War full control over any channel at the mouth of the Mississippi in which excavations may be going on, with authority to establish regulations for its use and providing punishment by fine and imprisonment for violating such regulations, came up for consideration. It is aimed at the New Orleans Tug Boat Association, which is said to systematically obstruct the channels under improvement in order to compel vessels to use its tugs. Nearly all the speakers agreed that to give an officer authority to make regulations would be unconstitutional. Recommitted to the Committee on Commerce.

The bill to pay the bonds of the Louisville & Portland Canal was taken up and passed. It provides that the Secretary of the Treasury take possession of the canal within 30 days from the passage of the act; that it shall be held for the free use of all, subject only to such tolls as may be necessary to pay current expenses, which for this year will be 10 cents per ton of capacity for steamboats and 5 cents for other vessels.

In the House, during the week ending the 24th, a bill to amend the act to prevent cruelty to animals while in transit was introduced. It provides that cattle may be carried 37 hours without unloading for rest, water and food, instead of 28, which is the limit now prescribed.

In the House on the 26th:

Mr. Page, of California, moved to suspend the rules and pass a bill, which had received the unanimous approval of the Committee on Public Lands, declaring forfeited to the United States all lands granted by Congress in 1866 for a railroad from Folsom to Placerville, Cal., the grant having expired by limitation. The rules were suspended and the bill passed.

In the Senate on the 27th:

Mr. Morton, of Indiana, moved that the Senate proceed to the consideration of the resolution offered by him to create a commission of five to report on the legislation needed for railroads which carry between different States, and made a speech, arguing in favor of the authority of Congress to regulate commerce on such roads, and indicating the extent of such regulating power as follows:

"Following the analogy of the power over navigation, Congress might adopt regulations looking to the safety of passengers, regularity of trains, uniformity of operation, certainty of connections, inspections of tracks, bridges, and locomotives, and many other particulars tending to promote the safety, efficiency, and development of the railroad system and the interest and convenience of the people. The power of congress to regulate freights and fares has never been exercised in connection with navigation, but that does not disprove its existence, for the powers of Government generally lie dormant until occasion calls them forth.

* * * * * * * * *

"Common carriers are required to carry for all persons and at reasonable rates. Is there any doubt that the State in one case, or Congress in the other, may determine what are reasonable rates? If there be a doubt in regard to the State, it must arise from the charter, giving the company power to regulate freights and fares in the nature of a contract between the State and the company, which power is gravely questioned, but which he would not discuss. But such contract is not binding upon Congress, and cannot limit its power to regulate inter-State commerce. The Constitution says no State shall pass a law impairing the obligation of contracts, but this is binding only on States, not on Congress. A State can make no contract with corporations which would restrain Congress, however binding it might be on the State."

In the House on the 27th:

Mr. Morey, of Louisiana, from the Committee on Public Lands, reported a bill reviving a grant of lands to aid in the construction of a railroad from Vicksburg, Miss., to the Texas State line.

Mr. Houghton, of California, from the Pacific Railroad Committee, reported a bill to incoperate the Southern Transcontinental Railroad Company and to grant it the right of way through the public lands.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—At the annual meeting of the Boston & Lowell Railroad Company, recently, Francis B. Crowninshield, Josiah G. Abbott, Hocum Hosford, George Stark and William A. Burke were elected directors.

—At the annual meeting of the Junction & Breakwater Railroad Company, at Milford, Del., January 12, Charles C. Stockly, Benjamin Burton, Curtis S. Watson, Harbeson Hickman, Edward D. Hitchens, Thomas Baumgardner and John A. Sheaff were elected directors.

—At the annual meeting of the Smyrna & Delaware Bay Railroad Company, in Smyrna, Del., January 14, John F. Bingham, John H. Hoffecker, H. C. Douglas, N. E. Wilds, B. S. Gootee, Peter Ward and J. Stockly were elected directors.

—At the annual meeting of the Philadelphia & Chester County Railroad Company, January 12, Tryon Lewis was elected President, and the following board of directors: Wm. C. Prichett, Levi Lukens, Thomas H. Powers, John Ashhurst, Thos. S. Cox. J. M. Pomeroy, William Evans, Samuel R. Downing, Barton D. Evans, William P. Thomas, R. Johnston, Enos Williamson.

—At the annual meeting of the National Car Company, in St. Albans, Vt., recently, the following directors were elected: L. Millis, J. W. Hobart, James R. Langdon, Jo. D. Hatch, M. Hall Stanton, Martin L. Hall, H. Shackell. L. Millis was elected President, and F. S. Stranahan, Clerk and Treasurer.

—At the annual meeting of the Vermont Iron and Car Company, in St. Albans, Vt., the following directors were elected: Otis Drury, Boston; James R. Langdon, Montpelier, Vt.; J. D. Hatch, Burlington, Vt.; J. W. Hobart, J. M. Foss, J. W. Newton, St. Albans, Vt.; H. R. James, Ogdensburg, N. Y. The board elected J. R. Langdon, President; G. G. Smith, Vice-President; F. S. Stranahan, Secretary.

—At the annual meeting of the East Brandywine & Waynesburg Railroad Company, in Waynesburg, Penn., January 12, Strickland Kneass, Dr. J. M. McClure, T. M. Storb, A. Diller, B. F. Kinzer, John S. Parker, William D. Smith, Wm. Morton, A. Graham, A. Rank, John Styer and James McClune were elected directors. John Cornog was chosen President; R. W. Morton, Treasurer, and Thomas Millard, Secretary.

—Mr. Hugh J. Jewett has been appointed First Vice-President and General Manager of the Pittsburgh, Cincinnati & St. Louis Railway Company, in place of J. N. McCullough, who still remains General Manager of the Pennsylvania Company.

—At the annual meeting of the Norwich & Worcester Railroad Company in Norwich, Conn., January 14, the old board of directors was re-elected, as follows: A. F. Smith, John F. Slater, Norwich, Conn.; F. H. Dewey, George W. Gill, Charles W. Smith, Edward L. Davis, Worcester, Mass.; William F. Weld, Boston; Robert Bayard, New York.

—At the annual meeting of the Woodstock Railroad Company in Woodstock, Vt., recently, Frederick Billings, Albert G. Dewey, Prosper Merrill, Charles Dana, Francis W. Clarke, Lewis Pratt, Frank N. Billings, Charles S. Raymond and Otis Chamberlain were chosen directors.

—At the annual meeting of the North Pennsylvania Railroad Company in Philadelphia, January 12, Mr. Franklin A. Comly was re-elected President, with the old board of directors, as follows: John Jordan, Jr., J. Gillingham Fell, William C. Lud-

wig, Ellwood Shannon, Edward C. Knight, Alfred Hunt, William C. Kent, Thomas Smith, James H. Stevenson, Philadelphia; Ario Pardee, Hazleton, Pa. The Philadelphia City Councils have elected Jacob Reiguel and O. Howard Wilson city directors in the company.

—At the annual meeting of the Chester Creek Railroad Company, January 12, Isaac Hinckley, Joseph Bringhurst, David Woelpper, A. P. Morgan and Amos Gartside were chosen directors. Samuel M. Felton was elected President.

—At the annual meeting of the Philadelphia & Baltimore Central Railroad Company, January 12, Samuel Dickey, David Woelpper, Edwin Haines, John Hulme and Robert H. Lamborn were elected directors. Henry Wood was re-elected President.

—The two branches of the Philadelphia City Council in joint convention recently elected Robert Thompson, W. C. Stevenson and John Noblitt, city directors of the Philadelphia & Erie Railroad Company.

—At the annual meeting of the Pennsylvania & Delaware Railroad Company, January 12, George S. Jones, John M. Pomeroy, George W. Smith, Charles Weiler, William S. Sager, William Reybold, F. P. Nicholson, Joshua B. Broomall and Chandler Phillips were elected directors. The board elected Charles Weiler, President, and Walter B. Mitchell, Secretary and Treasurer.

—At the annual meeting of the West Chester & Philadelphia Railroad Company in Philadelphia, January 12, the old officers were re-elected, as follows: President, Edward Hoopes, Philadelphia; directors, M. Baird, George Callaghan, Albert C. Roberts, Samuel J. Sharpless, Philadelphia; Lorenzo Beck, Charles Fairlamb, West Chester, Pa.; J. E. Farnam, Media, Pa.; D. B. Kelly, Kellyville, Pa.; Samuel Riddle, Glen Riddle, Pa. Thomas H. Hall was re-elected Treasurer and A. Lewis Smith, Secretary.

—At the annual meeting of the Chester Valley Railroad Company in Philadelphia, January 12, John F. Gilpin was chosen President and Franklin B. Gowen, Coffin Colket, Chas. E. Smith, H. P. McKean, R. B. Cabeen, A. E. Borie and Wm. H. Holstein, directors.

—At the annual meeting of the Lehigh Valley Railroad Company in Philadelphia, January 20, Hon. Asa Packer was re-elected President, with the old board of directors, as follows: Charles Hartshorne, William W. Lonstreth, J. Gillingham Fell, William H. Gatzmer, William A. Ingham, Joseph Wharton, George B. Markle, Philadelphia; David Thomas, Catasauqua, Pa.; William L. Conyngham, Wilkesbarre, Pa.; Ario Pardee, Hazleton, Pa.; Ashbel Welch, Lambertsville, N. J.; John Taylor Johnston, New York.

—At the annual meeting of the Ligonier Valley Railroad Company, January 12, Col. S. H. Baker was chosen President and R. M. Graham, John McFarland, M. Keffer, F. Smith, Capt. John Ourster, W. A. Bair and J. Brenizer, directors. George L. Miller was chosen Chief Engineer, John Hargnett, Secretary, and John McFarland, Treasurer.

—The annual meeting of the Lafayette, Bloomington & Mississippi Railroad Company at Bloomington, Ill., January 20, resulted in a dispute between the representatives of the town and county stock and the other stockholders. The town representatives chose the following directors: N. S. Sunderland, Norval Dixon, Bloomington, Ill.; F. Michling, Cheney's Grove, Ill.; J. H. Collier, Gibson, Ill.; T. W. Maurice, Arrowsmith, Ill.; M. Dunlap, Paxton, Ill.; F. Henderson, Towanda, Ill.; W. F. Youngblood, Hoopston, Ill.; P. Van Weidner, Padua, Ill.; O. D. Sackett, Ford County, Ill.; R. Butterfied, Vermilion County, Ill. The board chosen by the other stockholders was as follows: A. Gridley, J. H. Cheney, O. T. Reeves, Bloomington, Ill.; W. H. Pells, Paxton, Ill.; C. M. Smith, Springfield, Ill.; James Spears, Lafayette, Ind.; A. Anderson, J. D. Cox, J. S. Casement, J. N. Drummond, W. B. Corneau, Toledo, O.; A. B. Bayliss, New York.

The first-named board of directors elected Franklin Henderson, of Towanda, Ill., President.

—At the annual meeting of the Sheboygan & Fond du Lac Railroad Company in Fond du Lac, Wis., January 21, the following directors were chosen: A. G. Ruggles, E. N. Foster, J. A. Bentley, Sheboygan, Wis.; D. M. Green, Princeton, Wis.; Edwin Slade, Glen Beulah, Wis. J. A. Bentley was chosen President; A. G. Ruggles, Vice-President and Treasurer; Edwin Slade, Secretary.

—At the annual meeting of the Oshkosh & Mississippi River Railway Company, in Oshkosh, Wis., January 21, Joseph Stringham, James Jenkins, S. B. Page, Nelson Fletcher, R. G. Washburn and George Garey were elected directors.

—At the annual meeting of the Milwaukee & St. Louis Air Line Railroad Company, in Milwaukee, January 21, the following directors were elected: J. H. Van Dyke, E. P. Allis, George Burnham, John Black, R. W. Pierce, Joshua Stark, Milwaukee; C. C. Merrick, Chicago; Philo Belden, Rochester, Wis.; C. W. Marsh, Sycamore, Ill.; J. H. Johnson, Woodstock, Ill.; T. D. Brewster, Peru, Ill. The board elected officers as follows: President, Joshua Stark: Vice-President, T. D. Brewster; Secretary, William G. Parsons; Treasurer, John Black; Chief Engineer, John F. Murrell; Executive Committee, John Black, T. D. Brewster, R. W. Pierce, C. C. Merrick.

—At the annual meeting of the Davenport & St. Paul Railway Company in Davenport, Ia., January 21, 5,553 shares were voted on and the following directors were elected: G. H. French, G. H. Parker, J. H. Berryhill, John E. Henry, M. Donahue, A. C. Fulton, Davenport, Ia.; J. E. Goodenow, Maquoketa, Ia.; George Rule, Big Rock, Ia.; F. B. Doolittle, Delhi, Ia.; G. W. Lathrop, Oxford Mills, Ia.; G. S. Brunson, Fayette, Ia.; A. Beadle, Cresco, Ia.; J. R. Cook, Rochester, Minn. The board elected George H. French, President; M. O. Barnes, Vice-President; J. S. Connor, Secretary and Treasurer; and Messrs. French, Parker, Donohue, Fulton and Berryhill, Executive Committee.

—The Talladega, Nashville & Montgomery Railroad Company was organized at Talladega, Ala., December 18 by the election of the following directors: R. H. Isbell, P. G. Stringer, Joseph H. Johnson, E. R. Smith, N. J. Skaggs, Nich. S. McAfee and George L. Ragland. The board subsequently met and elected Capt. R. H. Isbell, President; Mr. James Gillespy, Secretary and Treasurer; Col. Taul Bradford, Solicitor and Attorney, and Mr. E. A. Crandall, General Agent. The address of the company is Eastaboga, Talladega Co., Ala.

—At the annual meeting of the Montreal & Vermont Junction Railroad Company at Stanbridge, Quebec, recently, the following board of directors was elected: P. H. Moore, J. Gregory Smith, Joseph Clark, A. B. Foster, W. C. Smith, Jo. D. Hatch, F. D. Des Rivieres.

—E. Ellery, of New York, has been appointed Assistant Treasurer of the Chicago, Danville & Vincennes Railroad, with office in Chicago.

—At a meeting in St. Louis January 22, the Keokuk Northern Packet Company elected the following board of directors: John S. McClure, W. F. Davidson, N. Mulleken and Thomas B. Rhodes, St. Louis; Adams Jacobs, Brinnsville, Pennsylvania; R. C. Gray, Pittsburgh; P. S. Davidson, La Crosse, Wis.; D. Hurdins, Galena, Ill.; W. H. Rhodes, St. Paul. The board subsequently elected the following officers for the ensuing year: President, John S. McClure; Secretary and Treasurer, Thomas H. Griffiths; General Superintendent, P. S. Rhodes.

—At the annual meeting of the stockholders of the Chicago, Pekin & Southwestern Railroad Company last week the following officers were elected: President, F. E. Hinckley; Vice-President, Ralph Plumb; Treasurer, N. E. Tyler; Secretary, F. Plumb; Superintendent, N. J. T. Dana; Directors, F. E. Hinckley, Chicago; Ralph Plumb, Streator, Ill.; N. J. T. Dana, Streator, Ill.; W. H. W. Cushman, Ottawa, Ill.; N. P. Sisson, Pekin. Ill.; B. H. Harris, N. E. Tyler, Jay Baker, J. H. Anthony; P. B. Shumway, Chicago; J. W. Dougherty; F. Plumb, Streator, Ill.

—Mr. J. B. Maxon has been appointed Road Master of the Chicago, Burlington & Quincy Railroad, in place of E. W. Hoyt, resigned.

—Mr. George H. Crain has been appointed Master of Track and Transportation on the main line (Shreveport to Dallas) and the Jefferson Division of the Texas & Pacific Railway.

—Mr. George H. Rice, Agent for the Central Pacific Railroad at Salt Lake, Utah, has been appointed General Superintendent of the Palisade & Eureka Railroad.

—The St. Louis *Railway Register* says:

"D. R. Garrison of this city, former President of the Missouri Pacific Railroad, has been re-elected to that position in place of T. B. Edgar resigned."

—At the annual meeting of the Logansport, Crawfordville & Southwestern Railway Company, January 21, a new board of directors was chosen, which elected officers as follows: President, S. D. Schuyler; Vice-President, D. D. Dikeman; Secretary, James H. Parris.

TRAFFIC AND EARNINGS.

—The earnings of the Great Western Railway of Canada for the week ending January 2 were: 1874, £21,377; 1873, £17,551; increase, £3,826, or 21¾ per cent.

—The earnings of the Grand Trunk Railway for the week ending January 3 were: 1874, £34,000; 1873, £28,900; increase, £5,100, or 17⅝ per cent.

—The earnings of the Philadelphia & Erie Railroad for the year ending December 31 were: 1873, $4,045,209; 1872, $3,980,752; increase, $64,457, or 1⅝ per cent.

—The earnings of the Mississippi & Tennessee Railroad for the month of December, 1873, were $72,968.42, or $730 per mile.

—The earnings of the Lehigh Valley Railroad for the year ending November 30 were:

Earnings ($27,961 per mile)	$6,710,564 67
Expenses (57.89 per cent)	3,884,860 07
Net earnings ($11,774 per mile)	$2,825,704 60

—The earnings of the Erie Railway for the second week in January were: 1874, $401,769; 1873, $343,909; increase, $57,860, or 16¾ per cent.

—The earnings of the St. Louis & Southeastern Railway (consolidated) for the second week in January were: 1874, $22,398.98; 1873, $18,537.43; increase, $3,861.55, or 20⅝ per cent.

—The earnings of the Philadelphia, Wilmington & Baltimore Railroad for the year ending October 31 were:

Earnings ($31,911 per mile)	$3,159,120 72
Expenses (64.64 per cent.)	2,042,269 90
Net earnings ($11,281 per mile)	$1,116,850 82

—The earnings of the Delaware Railroad for the year ending October 31 were:

Earnings ($6,360 per mile)	$534,270 92
Paid lessee for operating road, 72 per cent	384,963 07
Net earnings	$149,307 85
Dividends and interest	125,093 41
Surplus	$24,214 44

—The earnings of the Philadelphia & Baltimore Central Railroad for the year ending October 31, 1873, were: passengers, $134,311.37; freight, $160,166.67; sundry sources, $8,743.05; total, $303,221.09, or $5,320 per mile.

—The earnings of the Junction & Breakwater Railroad for the year 1873 were:

Earnings ($1,650 per mile)	$66,003.48
Expenses (54¼ per cent.)	35,789.52
Net earnings ($755 per mile)	$30,213.96
Interest	24,372.50
Surplus	$5,841.46

—The coal tonnage of the Columbus & Hocking Valley Railroad for the year 1873 was 869,204 tons, an increase of 27½ per cent. over the previous year.

—During the year 1873, the Marquette, Houghton & Ontonagon Railroad carried 659,894 tons of iron ore, and 21,999 tons of pig iron.

—During the year 1873, there passed over the Peninsula Division of the Chicago & Northwestern Railway, 503,932 tons of iron ore and 9,248 tons of pig iron.

—The earnings of the Eastern Railroad, including its leased lines, for the year ending September 30, 1873, were:

Earnings ($10,670 per mile)	$2,827,641.86
Expenses (70⅝ per cent.)	2,004,746.28
Net earnings ($3,105 per mile)	$822,895.58

—The Rockford, Rock Island & St. Louis Railroad earned in the month of October last $75,189.85, during which time the working expenses, rents and taxes were $55,288.96, leaving $19,900.89 as net earnings. For the four months ending with October (which should be the most productive of the year), the gross earnings were $293,290.71, the working expenses, rent and taxes $225,491.07 (77 per cent.), and net earnings $67,799.64. The interest on the funded debt (at 3½ per cent.) accruing during the same time was $105,000.

—The earnings of the Long Island Railroad for the year ending September 30, 1873, were:

Earnings ($4,895 per mile)	$895,716 38
Expenses (60.57 per cent.)	542,557 07
Net earnings ($1,930 per mile)	$353,159 31

—The earnings of the South Side Railroad of Long Island for the year ending September 30, 1873, were:

Earnings ($6,874 per mile)	$488,034 44
Expenses (139.49 per cent.)	680,766 61
Deficiency	$192,732 17

—The earnings of the Fitchburg Railroad for the year ending September 30, 1873, were:

Earnings ($14,886 per mile)	$1,399,312 75
Expenses (75.70 per cent.)	1,059,234 10
Net earnings ($3,618 per mile)	$340,078 65

The gross earnings show an increase of 3⅝ per cent., and the net earnings an increase of 5 per cent. over the previous year.

PERSONAL.

—C. D. Hammond, Assistant Superintendent, and P. H. Conners, Train Dispatcher, of the Northern Division of the New York & Oswego Midland Railroad, have resigned their positions.

—Mr. Edward Lee Plumb, agent of the International Railroad Company in Mexico, expects to leave Mexico for New York about the end of January.

CHICAGO RAILROAD NEWS.

Illinois Central.

The loss to this company by the fire on the night of January 19, which destroyed the baggage and depot building, at the head of Lake street, was about $15,000 and no insurance, viz., about $8,000 damage to cars and the half value of the buildings, about $7,000. The company has commenced the reconstruction of the building with brick and in a more substantial manner than before. The estimated cost of the new structure is some $15,000.

Chicago, Burlington & Quincy.

This company lost by the fire about 100 pieces of baggage and damage to cars equal to about $12,000. The company estimates its total loss at about $25,000, which was two-thirds insured.

Michigan Central.

A loss of about $20,000 was sustained by this company, viz., two cars, the half value of the depot building, and some 60 pieces of baggage, which was pretty well covered with insurance.

Milwaukee & St. Paul.

This company reports considerably increased receipts, both from passengers and freight, during the past two weeks.

ANNUAL REPORTS.

Boston & Albany.

This company owns the road from Boston to Albany, 201.65 miles; the Grand Junction road, from Brighton to East Boston, 9.3 miles; the Brookline Branch, 1.55 miles; the Newton Lower Falls Branch, 1.1 miles; the Saxonville Branch, 3.7 miles; the Milford Branch, 12 miles; the Millbury Branch, 3 miles; the Hudson & Boston road, Chatham, N. Y., to Hudson, 17.33 miles; making in all 249.63 miles owned. It also operates under lease the Pittsfield & North Adams road from Pittsfield to North Adams. 18.65 miles, making 268.28 miles operated.

For the year ending September 30 the operations were as follows:

Receipts.	1873.	1872.
Passengers	$3,011,562	$2,880,884
Freight	6,221,183	5,846,768
Express	233,271	201,516
Mails	74,5 5	74,000
Rents and interest on investments	257,491	256,431
Total earnings	$9,798,032	$9,259,599
Expenses.		
Maintenance of road	1,862,619	
Motive power	765,283	
Maintenance of cars	701,949	
Buildings, ferry, etc	98,194	
Transportation expenses	3,975,693	
General expenses	157,421	
Total expenses	$7,561,159	$6,896,984
Net earnings	2,236,873	2,362,615
Interest on bonds	218,909	
Dividends, 10 per cent	1,976,410	
Pittsfield & North Adams dividends	27,000	
	$2,222,319	
Surplus	$14,454	

This shows an increase of $538,433, or 5¾ per cent. in gross earnings; an increase of $664,175, or 9¾ per cent. in expenses; and a decrease of $125,742, or 5 7-16 per cent. in net earnings.

The mileage of passenger trains was 1,299,412 miles; freight trains, 4,224,050 miles; gravel and other trains, 138,092 miles; total, 5,661,554 miles. The trains carried 71,752 through and 5,685,872 local passengers, a total of 5,757,624, equivalent to 120,662,660 carried one mile. The freight moved was 2,884,520 tons, equivalent to 317,670,752 tons carried one mile. The increase in passenger mileage was 6¾ per cent., and in tonnage mileage 9¼ per cent. The tonnage eastward to Boston was 1,005,188 tons, and westward from Boston 480,994 tons.

The percentage of operating expenses to receipts was 77.17, against 74.48 per cent. the previous year. The gross earnings for the year were at the rate of $36,560 and the net earnings $8,347 per mile.

The equipment consists of 231 locomotives; 183 passenger and 52 mail and baggage cars; 2,839 box, 553 platform, and 1,150 coal cars; 509 gravel and other cars and 7 snow plows. During the year 18 engines have been built and 12 purchased; 20 passenger train cars and 851 freight cars built.

About 6,000 tons of steel rails have been used in renewals. Five iron and four stone bridges have been built to replace wooden bridges and five wooden bridges have been rebuilt. The iron superstructure for one track of the new bridge at Springfield has been completed and work is progressing on the second track. The Union depot at Worcester is well under way, and new freight houses have been put up at Worcester and Springfield. Additions have been made to the shops both at Boston and Albany. The property bought last year in Brighton is being graded and drained.

The capital stock is now $19,864,100, or $79,456 per mile, an increase of $200,000 since the last report. The funded debt is $4,319,000, or $17,276 per mile, an increase of $1,282,000 during the year. The contingent fund amounts to $1,596,490, and the accumulated sinking fund profits to $1,667,470.

OLD AND NEW ROADS.

Alabama & Chattanooga.

The Montgomery (Ala.) *Advertiser* says:

"Major L. J. Fleming, Superintendent of the Alabama & Chattanooga Railroad, has made a report to the Judge of the United States Court at Mobile. In this report he affirms that the earnings of the road for a year from Nov. 1, 1872, were $232,586.96, while the expenses were $1,083,852.90. He declares that the figures show that the earnings cannot be relied upon either to place the work in proper condition or to keep it in operation for any great length of time. This very small business is due in some measure to the want of confidence in the safety of the road, and the doubt as to how long it will run."

He also states that it will now require $1,500,000 to put the road in good order.

In the United States Circuit Court at Mobile, Ala., January 24, Judge Woods made a decree ordering the sale of this road to take place May 4. According to the decree no bid less than $5,000,000 can be received, and the proceeds of the sale are to be used to extinguish the claims of the first-mortgage bondholders.

The Detroit Bridge.

The report of the commissioners appointed by the Secretary of War to inquire into the feasibility of bridging the Detroit River has been laid before Congress. The commissioners have given a hearing to all parties interested and have collected statistics bearing on the question. They are inclined to think the water traffic much more important than the railroad traffic which crosses the river and believe that a tunnel is the only unobjectionable method of overcoming the obstruction to railroad traffic. This tunnel they believe to be practicable. No bridge giving passage to vessels by draws alone, with any draw-span now possible, can